compound and having a lower concentration of chlorinated impurities than said reactor stream, said side stream comprising said extractive agent and said chlorinated impurity, said bottoms stream comprising said extractive agent and having a lower concentration of said chlorinated impurity than said side stream;

a second conduit for supplying at least a portion of said side stream to said fluorination reactor; and

a third conduit for supplying at least a portion of said bottoms stream to said distillation unit.

18. (Withdrawn)The system of claim 17, further comprising:

a device for adjusting the flow rates through said first conduit, said second conduits or a combination thereof.

19. (Withdrawn)The system of claim 17, wherein said device is a valve in said third conduit for diverting a portion of the bottoms stream from said distillation unit to said fluorination reactor.

REMARKS

Rejections of Form

The examiner objected to the abstract, stating that it contained legal phraseology often used in patent claims such as the term "comprising." In response, applicant has amended the abstract to eliminate such terminology. Applicant submits that this amendment should obviate the examiner's rejection.

The examiner rejected claims 1-11 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to point out and distinctly claim the subject matter which the applicant considers the invention. Specifically, the examiner stated that "it is unclear where the purified difluoromethane is recovered, if in overheads or at the bottoms of the distilling

process." In response, applicants has amended claimed invention to indicate that the product stream from which the difluoromethane is recovered is in the overheads stream.

The examiner also rejected the claims, stating that the term "impurity" was used inconsistently in the claims–i.e., claim 1 recites both "at least one impurity" and "said impurity." The examiner made a similar rejection with respect to the term "extractive agent". In response, applicant has amended the claimed invention to make the terminology consistent.

The examiner also rejected claims 8 and 9 for using the abbreviation HFC – 32 without first reciting the compound dichloromethane. In response, applicant amended claims 8 and 9 to specify difluoromethane instead of HFC--32. Applicant submits that this amendment should obviate the examiner's rejection.

Prior Art Rejections

The examiner rejected claims 1-11 under 35 U.S.C. 103(a) as being unpatentable over WO 9907660 in view of the Coulson et al. publication and Yokoyama et al. Specifically, the examiner stated that WO 9970660 discloses substantially the process as claimed. The examiner stated, however, that the process of WO 9907660 differs from the claimed invention in that the claimed invention specifically recites the use of dichloromethane as an extractive agent. The examiner then proceeded to argue that a particular combination of prior art references supported a prima facie showing that the use of dichloromethane is obvious in light of WO 9907660. In response, applicant wishes to point out that WO 9907660 does indeed disclose the use of dichloromethane as an extractive. Specifically, on page 12, line 9, WO 9907660 states that "representative chlorocarbon extractive agents include methylene chloride . . . ." Methylene chloride and dichloromethane are the same. Therefore, this reply and subsequent prosecution will treat this reference as disclosing dichloromethane as an extractive agent.

Without prejudice, the claimed invention has been amended to recite that the extractive distilling step produces at least one extractive agent stream comprising a mixture of the impurity and dichloromethane and that at least a portion of this stream is supplied to a fluorination reaction which produces the difluoromethane. As mentioned in the application,

the claimed invention has significant benefits. Aside from forming a non-ideal mixture with H.C.-32, dichloromethane is particularly advantageous as an extractive agent since it also is a starting material in the fluorination of H.C.-32. Consequently, after effecting increased relative volatility between the constituents of the reactor stream and thereby facilitating extractive distillation, the dichloromethane and impurities may be removed from the distillation unit and used to feed the fluorination reaction. Thus, the need for additional distillation steps to separate the extractive agent from the impurities is eliminated.

Furthermore, with respect to the process recited in claims 3, 8-11, the claimed invention also eliminates problems typically encountered when the fluorination and purification processes are interrelated. That is, although recycling the extractive/reactant to the fluorination reactor avoids the need for additional distillation steps to separate the extractive form the impurities, it makes the distillation and fluorination operations interdependent upon one another. This interdependency generally requires that the amount of extractive agent used in the extractive distillation process be no more than that consumed in the fluorination reaction. Otherwise, the extractive agent/starting material will build up in the fluorination reactor and thereby reduce productivity.

The process of claims 3, 8-11 overcomes this interdependency problem by providing a novel fluorination/distillation configuration that allows for the independent operation of the fluorination and extractive distillation processes. More specifically, the extractive distillation is performed such that the extractive agent is fractionalized into a side stream and a bottoms stream. The side stream comprises a mixture of the extractive agent and impurities while the bottoms stream has a relatively-low concentration of impurities. The side stream may be supplied to the fluorination reaction. The bottoms stream may be recycled into the distillation column providing that it is sufficiently low in impurities. This configuration enables the amount of extractive agent recycled to the fluorination reaction and to the extractive distillation column to be adjusted for optimum performance. More specifically, the flow rates of the side stream and bottoms stream may be adjusted to optimize fluorination and distillation conditions.

Therefore, the claimed invention not only provides for a purification approach which eliminates the need for separating the impurities from the extractive, but also, in a preferred embodiment, eliminates problems with the interdependency of the fluorination/purification processes.

The cited prior art is devoid of any teaching or suggestion of the claimed invention. First, there is no suggestion in WO 9907660 of recycling at least a portion of the extractive agent stream to the fluorination process. To the contrary, the distillation approach in WO 9907660 is independent from the fluorination process. This is not surprising given the fact that most of the extractives disclosed in WO 9907660 are not reactants in the preparation of the desired fluorinated product. Indeed, the uniqueness of methylene chloride as being both an extractive and a reactant was apparently overlooked.

Since WO 9907660 fails to recognize the synergies of using an extractive which is also a reactant, it, quite naturally, is not faced with problems of having the fluorination and purification processes interdependent. Motivation to modify a reference is often based upon the problem to overcome. Since the problem of interdependent fluorination and purification processes is non-existent in WO 9907660, there is no motivation to control the amount of extractive being recycled to the fluorination process. Accordingly, there is no motivation in WO 9970660 to provide both a side stream and a bottom stream in the extractive distillation so that the flows of each may be controlled to optimize the fluorination and distillation processes. The rejection should therefore be withdrawn and the claims allowed.

Respectfully submitted,

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